Property Rights and Environmental Policy: A New Zealand Perspective

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Abstract

This paper is intended to lay out a preliminary foundation for applying a property rights perspective to environmental policy issues facing New Zealand. It does not attempt to apply such an approach to any specific issue. Rather it summarises the core principles behind effective rights regimes (illustrated by the evolution of rights over time), reviews how such regimes have been applied to environmental issues internationally, and describes current natural resource rights regimes in New Zealand.

The purpose of applying property rights to the environment can vary widely and reflect quite different perspectives. Regulation by any form, however, whether command-and-control or market-based, creates or modifies property rights. While private property rights will not always be appropriate, the alternatives redefine and reallocate rights rather than eliminating them. A common or public property right remains a right held by someone. The choice is not therefore whether to modify property rights to improve environmental outcomes, but how to do so in a way that optimises national welfare.

However, if more use of market-based instruments is appropriate, then the work required to create the legal, institutional and scientific framework to successfully implement them (including trading off social, economic and environmental outcomes) should not be under-estimated. Fishing and water rights demonstrate these difficulties and the payoff (for fisheries at least) that can be achieved.

JEL CLASSIFICATION

D23 - Organizational Behaviour; Transaction Costs; Property Rights,

H23 - Externalities; Redistributive Effects; Environmental Taxes and Subsidies

K11 - Property Law

P14 - Property Rights

Q15 - Land Ownership and Tenure; Land Reform; Land Use; Irrigation

Q24 - Land

KEYWORDS

Property Rights, Transferability, Market Based Instruments (MBI), Environmental Policy, New Zealand

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1 Introduction

This paper surveys those aspects of property rights and their creation, administration and trading that are of most relevance to environmental policy, with particular reference to current circumstances and active policy debates in New Zealand.[1]

It therefore begins in Sections 2, 3 and 4 by discussing general concepts such as the difference between private, common and public property, a set of characteristics by which property rights can be defined and the impact of variations in those characteristics on the value of rights (including the main arguments around restrictions on how and to whom rights can be transferred). Section 5 discusses environmental applications of property rights, with a particular focus on using taxes or permits, as opposed to more prescriptive regulatory tools, to control pollution control and manage natural resources (eg, water and fisheries).

Section 6 reviews key details around the major property rights regimes in New Zealand and the relationship between the Resource Management Act (RMA) and private property rights. Section 7 notes some uses of market-based instruments for these purposes in Australia. Concluding remarks are in Section 8.

2 Types of property

This section discusses those aspects of property that determine how rights to property can be defined and allocated. These aspects may be natural in origin (ie, individual segments of the atmosphere cannot be partitioned, constrained or tracked) or legal or customary (ie, common grazing lands or open access to beaches). Both constrain the manner in which property rights can operate, though the latter is more flexible.

[1] The discussion of property rights in this paper includes those property rights specifically defined by law, but excludes rights created privately under general contract law, securities law or matrimonial property law, as well as Treaty of Waitangi, aboriginal, and customary rights and intellectual property rights issues (including flora and fauna, genetic modification etc). It also excludes any property rights arising from the Kyoto Protocol. This is because each of these could justify a paper in its own right, and the additional light that would be thrown on broader property rights issues by such analysis is limited given the highly specific nature of the factors involved. Conversely, however, the discussion of the broader issues does provide some insight for these specific debates, as demonstrated by the discussion on transferability in Section 3.3.

2.1 Private, common, public and open access property

The terms private, common and public are often based on the concepts of excludability (who can determine who benefits from the resource) and rivalness (whether use is affected by the number of users). These concepts apply across a range of rights associated with property, such as access, withdrawal, management and exclusion (Schlager and Ostrom, 1992).

Taken together, these concepts and rights can be used to address the confusion often apparent in discussions of types of property, particularly between terms such as common and open access, which are sometimes used interchangeably. Broadly, the difference is that for common property, use is limited to members of the common group (although within that group constraints on use may or may not exist and their nature can vary widely), while for open access property there is no constraint on who can use it; ie, exclusion is impossible or costly (Cole, 1999).

Table 1 – Private, common, public and open access property

	Owner	Example	Access	Withdrawal	Management	Exclusion
Private	Private	Fee simple title to land.	Controlled by owner.	By owner.	By owner.	By owner.
Common	Group	Common land.	Controlled by joint owners.	By joint owners.	By joint owners.	By joint owners.
Public	State	National park.	Controlled by state.	None.	By state.	By state.
Open access	No one	Ocean fishery.	Uncontrolled.	Uncontrolled.	None.	None.

This difference is illustrated in the break-down in Table 1 of types of property into private property (generally excludable and rival), common property (group members have the right to exclude non-members), public property (owned by all, but with access and use controlled by the state), and open access property (where no one has the right to exclude anyone).[2]

Open access property may exist because ownership has never been established, because the state has legislated it, or because no effective controls are in place, or feasible, ie, the costs of exclusion outweigh the benefits (Ostrom, 1999). The state can sometimes effectively convert open access property into private, common or public property by legislating to define rights and enforce them.

Most newly defined property rights regimes tend to involve former common or open access property since private and public property tend to already be covered by generic

[2] These concepts are slightly different in their breakdown from the standard economic categorisation of goods into: private goods – excludable and rival; club goods – excludable and non rival within size of club; eg, a tennis court; and public goods – non excludable and non rival; eg, national defence.
Pure public goods are often confused in discussion with publicly provided goods with no inherent public good component.

This categorisation is used to discuss incentives for provision of goods, with public goods tending to be under-provided by individuals and therefore requiring state provision through taxation to address the free rider problem. A free rider problem is where potential consumers have an incentive to hide their true willingness to pay since they will still be able to consume the good without paying. If this effect is strong, public or club goods may be under-provided. Addressing this problem through coercion can create a forced rider problem where consumers bear a cost of provision that exceeds the benefits they receive. Compulsory payments can also be used to fund club goods (eg, the Commodity Levies Act 1990 for industry goods in New Zealand).

regimes, having generally been converted from common or open-access property in the past.

2.2 The "tragedy of the commons"

The tragedy of the commons is a well known story about the effects on a common property resource when the intensity of use reaches a level where rivalness becomes an issue (Hardin, 1968) and the resource is destroyed by uncontrolled use. The term is a misnomer as it is typically applied to open access resources. True commons, where rights are held and exercised by a group, can break down (particularly where individual and joint benefits of use diverge or where the size of the group hinders effective governance) but provide greater scope for managing conflicts through shared benefits and enforcement.

There are two key problems. One is that when individuals increase their use of the resource, they receive the full benefits associated with that increased use, but only bear their proportional share of the costs (eg, any additional degradation of the resource). The second is that no one has a guaranteed future entitlement to an absolute or proportional amount of the resource, so that incentives to preserve or develop the resource for future use are weak.

The incentives created by these problems drive users towards overuse, especially when the future benefits of restraint are discounted and restraint by others cannot be guaranteed.[3] This means that "anyone who refrains … does so not to his benefit but to the benefit of others who will continue to exercise their communal right" (Alchian and Demsetz, 1973, p20). The approach is one of first come, first served, and investments are limited to those which have short time horizons, generate high returns and are easily monitored (Pejovich, 1972). Land is therefore over-grazed and fisheries are exhausted. "Freedom in a commons brings ruin to all" (Hardin, 1968, p3).

The establishment of property rights held by individuals, corporates, communities or trusts) to avoid the tragedy of the commons has been strongest in land but is now becoming more prominent in areas such as fisheries where the ability to move vessels to exploit new fish stocks in other parts of the world is coming to an end and strongly illustrated by the tragedy of the commons effect in the North Atlantic cod fishery (Kurlansky, 1997). This is discussed further in Section 4.4.

3 The nature of property rights

This section discusses how to specify property rights, why they change, how private rights can evolve from Government actions, and how the community limits property rights.

Generally, property rights consist of separate and overlapping rights to possess, use and dispose of property. Not all these rights will necessarily be specified to the same degree, or allocated to the same owner (or allocated at all). In other words "It is not the resource itself which is owned; it is a bundle, or a portion, of rights to use a resource that is owned" (Alchian and Demsetz, 1973, p17).

[3] This illustrates the interconnectedness of ownership rights, incentives, and economic behaviour (Schmid, 1976).

3.1 Property rights in society

Which rights exist and who owns them (eg, individuals or the state) has major societal and economic implications. Rights themselves are also "the product of rules" and "all rights have complementary duties" on others to observe them (Schlager and Ostrom, 1992, p250). The concept of rights having matching duties, and only existing within a societal/legal context of rules is very important to how rights evolve.

In a more general historical context "one of the oldest themes in economics is the incompatibility of despotism and development. Economies in which security of property is lacking … should experience relative stagnation" (De Long and Shleifer, 1993, p671). Economic growth requires secure property rights.[4] The importance of rights and the necessary supporting institutions in economic development was also demonstrated in a recent study showing that institutions far outweighed government policies and geography as an explanatory factor (Easterly and Levine, 2002).[5] Institutions and rights, however, remain a necessary rather than sufficient factor for growth (Hausman and Rodrik, 2002)

This paper does not delve into issues of property right endowments. While the Coase Theorem suggests that the ultimate result (which maximises the value of production) is independent of the initial delimitation of rights because each right will be acquired by whoever places the highest value on it (assuming zero transaction costs) the initial allocation of rights does affect the distribution of the benefits of ownership when there are transaction costs (Coase, 1960).

3.2 Specification of property rights

There are several types of rights attached to any particular item of property. There are three such rights at the most fundamental level, the rights to use (access or withdraw resources), possess (manage and exclude from) and dispose of (alienate) property.

These rights can be combined in many different ways and broken down for a range of particular purposes. Freehold ownership of land is, after all, not the only option. The degree to which rights are specified and owned will in turn affect the incentives on rights owners for long-term management of the underlying resource.

The manner in which the rights are specified will also affect the valuation of the right.

[4] Another study looking at the effect of secure property rights on firms' willingness to invest in intangible assets (eg, intellectual property), rather than more easily protected fixed assets, found that "improved asset allocation due to better property rights has an effect … equal to improved access to financing arising from greater financial development" (Claessens and Leaven, 2002, p1)

[5] Similarly in China, there were concerns that more secure land rights undermined the function of land as a social safety net. Evidence, however suggested "that greater tenure security, especially if combined with transferability of land, had a positive impact on agricultural investment" without increasing inequality of land distribution or reducing "households' ability to cope with exogenous shocks", and that resistance to changed property rights reduced as familiarity increased (Deininger and Jin, 2002, p1).

Table 2 summarises some key types and characteristics of property rights. It is possible to delineate more categories, but those detailed here are sufficient for most purposes.

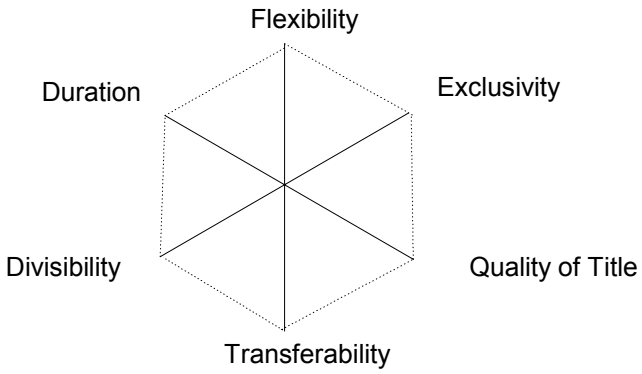
Table 2 – Specification of property rights

Nature of Right	Valuation Criteria	Characteristics of Rights	Incentives for private owners to maximise long-term value are optimal when rights are
Use of property.	Flexibility and divisibility.	Spatial – geographic area of right.	Universal – all relevant resources privately owned & entitlements completely specified.
Exclusive possession of property.	Exclusivity.	Property – whether government can modify right without compensation.	Exclusive – benefits and costs accrue only to owners.
	Duration.	Temporal – lifetime of right.	
	Quality of title.	Quality – actions possessor may take.	Enforceable - secure against seizure or encroachment.
Disposal of property.	Transferability.	Transferability – who right can be transferred to and whether approval is required.	Transferable – rights can be freely transferred.

Source: Valuation criteria from Scott (1988)[6] and Scott and Coustalin (1995). Characteristics of rights from Pennings, Heuman and Meulenberg (1996)

If these characteristics are measured along a star of axes (see Figure 1 and Figure 2) then a right that maximises each characteristic and, thereby, its value, creates a large hexagon when linking the end points of each axis.

Figure 1 – Six characteristics of efficient property rights



Source: Scott (1988) and Scott and Coustalin (1988)

Given societal trade-offs such a perfect right is unlikely to exist.[7] The approach does, however, allow alternative rights designs to be compared in a consistent manner, as long as each characteristic is consistently evaluated, with the total area delineated for each right reflecting its total value relative to the alternative designs. The comparison will be best for different types of interest in the same resource at the same location, but other comparisons are feasible. Such comparisons can also be represented in tabular form.

[6] *flexibility* – extent to which the owner can change the mode or purpose of resource use without forfeiting the right
divisibility – ability to create joint ownership, to divide the asset spatially or by function, to construct temporal succession of rights
quality of title – enforceability, certainty, security, ease of establishing ownership to enforce other characteristics
exclusivity – specificity, excludability, how many other parties to agree with on use, absolute if no actions by others affect your use
duration – permanence, length & arrangements for renewal
transferability – assignability, exchangeability, tradeability (increased transferability equals reduced exclusivity)

[7] The value of a right will be greatest when it persists in perpetuity, is completely flexible, certain and secure, can be simply and costlessly transferred, and where others can be completely excluded from use of the right.

Freehold and leasehold title for land are compared in Table 3, illustrating why the latter is usually sold at a lower value.

Table 3 – Comparison of tenure systems

Characteristic	Freehold title	Leasehold title
Duration.	100	20
Divisibility.	80	20
Transferability.	100	100
Quality.	100	80
Exclusivity.	50	50
Flexibility.	80	20

Source: Johnson (1992)

A perfect right is unlikely to occur in practice. However the closer that a rights regime approaches to that outcome, the more efficient will be the use of the underlying resources. For a land tenure system, for example, to facilitate wealth increase requires (1) a clear definition and allocation of property rights in land, reducing the cost of establishing ownership and scope of rights, (2) a method of distributing wealth created from land (the cost-reward structure) that creates an incentive for agents to use land in its most-valued uses net of transaction costs, internalising costs and benefits, and (3) freedom and legal enforcement of contracts, especially for sale or rent (Johnson, 1972).

Communal systems tend not to satisfy these criteria except where they have developed in response to economic forces (such as a surplus of land) which still apply.[8] Landlord-tenant systems can fail due to high contracting costs, particularly with low literacy and poorly developed legal systems or concentrated land ownership, but can be quite efficient. Owner-cultivator systems normally meet the second criterion, but to maximise incentives also requires the first, with the third important for economies of scale (Johnson, 1972).

Table 4 summarises a set of property rights and some related classes of property-rights holders. As the table illustrates, it is limiting to focus on only one aspect of property rights, or one category of rights owners. A number of alternative bundles of these rights are practicable, and may be efficient in particular circumstances. For example in terms of the coastal marine area, everyone in New Zealand is an authorised entrant for sailing purposes and an authorised user for recreational fishing, while only ITQ holders are able to take fish for commercial sale and to sell that right (ie, they have the right of alienation). Bundles may be held by individuals, communities, or the state (which normally also retains a residual right to constrain how any particular right or bundle of rights can be exercised).

[8] Common property rights are likely to develop for land where there is a low value of output per unit, highly variable resources, low returns from intensive investment, and large economies of scale in use and infrastructure. Participants desire accurate information about the resource, a common understanding of the benefits and risks of the *status quo* versus possible changes, norms of reciprocity and trust, stable membership, a long-term interest, collective choice rules that avoid unanimity or control by a less than a large majority, and accurate and low cost monitoring and sanctioning arrangements. Otherwise, efficiency of use will be reduced and the risk of resource depletion higher. Size and homogeneity of a group are also relevant but in a more complex manner.
There are also situations where individual ownership rights will be more efficient than common rights. This normally applies to land, where a formal title can significantly increase value, particularly through improved access to credit and incentives to invest. The same factors can apply to water and fishing, though individual environmental and social factors play a major role, and defining stocks and flows can be costly and uncertain. Crucial factors to define individual rights typically include measurement, monitoring and social acceptance of the legitimacy and fairness of the rules (Ostrom, 1999).

Table 4 – Bundles of rights and classes of rights owners

	Authorised Entrant	Authorised User	Claimant	Proprietor	Owner	Individual Transferable Quota (ITQ) for fishing
Access.[9]	X	X	X	X	X	X
Withdrawal.		X	X	X	X	X
Management.			X	X	X	
Exclusion.				X	X	
Alienation.					X	X

Source: Ostrom (1999) and Schlager and Ostrom (1992)

People other than freehold owners in the conventional sense can have substantial long-term interests in resource systems. An authorised user, for example, can have long-term rights to catch fish, but no influence over fishing rules and no power to stop others from fishing. A claimant would also have rights to set fishing rules, while a proprietor would add in the right of exclusion. None of these people, however, would have the key right of an owner, the right of alienation (Schlager and Ostrom, 1992).

This does not mean their rights are not real and valuable. It does mean, however, that proprietors and owners have a greater long-term incentive to invest in resource enhancement because they can exclude others from the resulting benefits. Authorised users on the other hand (such as recreational fishers), with no right to any involvement in the development of access rules, may only comply with those rules if given a strong incentive to do so (Schlager and Ostrom, 1992).

As noted above, a common pool resource occurs where the resource is indivisible, exclusion is costly and use is rival. For some such resources, state sanctions can overcome the exclusion problem.

3.3 Key characteristics of rights

When new rights are being defined, certain characteristics will be more important than others depending on the nature of the property and on the objectives of establishing it. Particularly important characteristics are duration, quality of title and transferability.

Quality of title can be a vague term but includes whether the right is absolute or proportional, compensability for changes in the terms of the right, and the existence and nature of institutions to enforce the right.[10] It is therefore crucial to the operation of a rights framework.

Where the underlying property covered by a right is depletable, or where investment can increase the value of property, or prevent its erosion, the duration of a property right and the arrangements for its renewal (if duration is not permanent), become crucial to the

[9] Access – right to enter and enjoy non-subtractive benefits
Withdrawal – right to obtain resource units or products of a resource system
Management – right to regulate internal use patterns and transform the resource through improvements
Exclusion – right to determine who will have access rights and withdrawal rights, and how those rights may be transferred
Alienation – the right to sell or lease management and exclusion rights

[10] When ITQ was first introduced in New Zealand it was for fixed quantities of fish each year, which was unrealistic for maintaining a sustainable fishery and required the Government to buy back rights in years when catches had to be reduced. The change to calculating ITQ as a proportion of the Total Allowable Catch (TAC), with a proviso that reductions for sustainability reasons were not compensable, created a more credible right over time.

incentives faced by the right owner. Those incentives then drive investment behaviour. Examples of where such factors can be significant include aquaculture leases and tourism concession arrangements in national parks.

Within duration, there is a specific issue of whether rights can be defined for sub-periods of time (eg, annual) rather than for their full duration, or whether annual access to permanent rights can be transferred separately. This type of approach has worked well for fisheries, where Annual Catch Entitlements (ACE) can be traded while retaining the underlying Individual Transferable Quota (ITQ), and for emissions trading programmes (Montero and Sanchez, 2002). This ability to divide the asset increases market liquidity and the management flexibility of the owners.

Transferability is also normally strongly reflected in value, but is discussed in its own right at more length below.

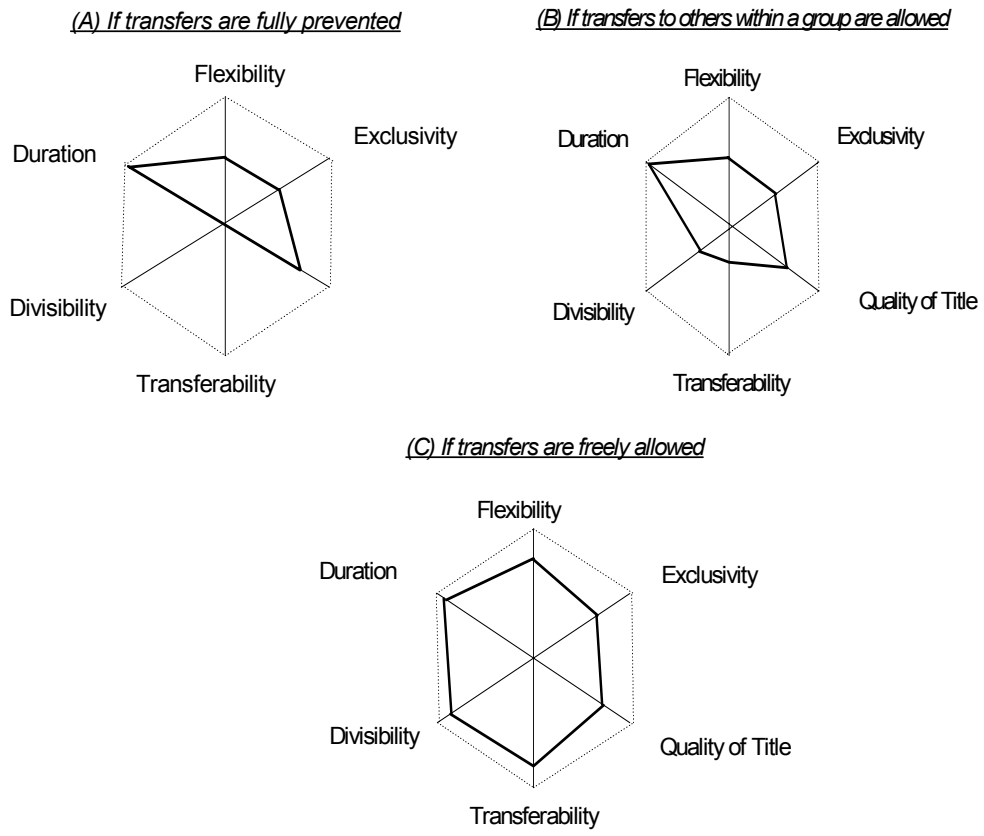
3.3.1 Transferability of rights

When property rights are defined or substantially redefined, there is often a call for restrictions on who they are issued to, and who they can then be traded to. The latter is more significant because of its effects on dynamic efficiency. Any problems created by the former are likely to resolve over time if the rights are freely transferable.

An illustration of the impact of transferability is the Individual Transferable Quota (ITQ) system in New Zealand as discussed in Section 6.4. Assets from the 1992 Maori fisheries settlement are to be allocated and distributed to iwi (tribes). Some restrictions have been proposed on transferability to ensure the assets remain in Maori control.[11] Figure 2 illustrates how such restrictions can affect value, using the approach outlined in Figure 1 (Clarke, 2002).

[11] No sales of quota would be allowed other than to recognised iwi or the Treaty of Waitangi Fisheries Commission – Te Ohu Kai Moana (TOKM), although the Annual Catch Entitlement (ACE) would be transferable for several years out.

Figure 2 – Transferability and value of fisheries quota



Source: Framework adapted from Scott (1988).

The irregular shape and reduced area where transfers are restricted suggest the poorer quality of such property rights, and are likely to be reflected in lower value. This is because the pool of potential buyers for the asset is reduced, the freedom of owners to structure their operations is limited, and the inability to transfer title discourages financial institutions from accepting the asset as collateral for loans. Previous examples of restricted transferability of property rights in New Zealand include shares in agricultural producer boards and ownership of Maori land under Te Ture Whenua Maori Act.

Those producer boards which traded in product historically (A) required growers to hold shares in order to supply required growers to invest in on-farm and off-farm assets in the same industry, thereby (1) concentrating their risks, (2) limiting access to external capital (3) reducing governance pressures on directors and (4) obscuring and reducing the true value of the shares.[12] The alternative approach of (B) restricting share transferability to within the industry allowed diversification of investments while retaining control within an industry group, but at the cost of reducing the value received by those who chose to exit, and creating tensions between payments for product and dividends on shares as shareholdings diverged from production.[13] The latter is a common problem for co-operatives with outside shareholdings. Free transferability of shares (C) allows diversification but at the cost of potentially ceding control.[14]

[12] Most of the dairy industry is now a single co-operative with shareholdings based solely on production, which appears to be experiencing the above disadvantages, with no obvious means of addressing them under the current model.

[13] This is the model adopted for Zespri, the former New Zealand Kiwifruit Marketing Board, in the kiwifruit industry, and is likely to result in the disadvantages listed here over time.

[14] In the apple industry growers chose to sell their shares, allowing them to diversify their investments and resulting in a takeover of the former NZ Apple and Pear Board (now ENZA) which subsequently merged with Turners & Growers Ltd, forming a major New Zealand entity across the horticultural sector. Such a positive outcome would not have been possible when ENZA was a dominant regulated

Restrictions on transfers of Maori land (see Section 6.5) are designed to protect the limited remaining land in Maori ownership. In practice, however, restrictions on the sale of land have raised the cost of changing the use or user of the land and reduced the profitability of any investments attached to the land, as well as the general issues noted above of a smaller market, lower value, limited usefulness as collateral. Restrictions on rental have a similar effect (Johnson, 1972). In addition the difficulty of locating owners and the costs of establishing and operating trusts severely affected the ability of owners to develop land thereby hindering economic development, particularly where land is the only significant asset held.

Precedents from Native American land tenure show the same general issues, and highlights the effect of inability to sell in preventing economic aggregation of land parcels and increasing the fragmentation of title among successors (Anderson and Lueck, 1992).[15] Multiple ownership in turn increases the costs of obtaining agreement among owners, reduces the willingness of individual owners to put effort into development, and discourages uses that may be more valuable but where monitoring of inputs and outputs by owners will be more difficult.

The per-acre value of agricultural output, compared to fee-simple land, was calculated in this study as 30-40% lower for individual trusts and 85-90% lower for tribal trusts. As Anderson and Lueck note this does not necessarily mean the constraints should be lifted, given the cultural and social goals on which they are based, but does indicate that there is a definite economic cost of pursuing such goals. An explicit choice should be made in each case if possible on whether the benefit justifies the cost. This raises difficult issues about a decision-making mandate where decisions are made on behalf of those affected by the state or some other representative group (itself possibly mandated by the state).

4 The evolution of property rights

Property rights are not immutable. They appear, evolve and vanish in response to economic, societal and environmental pressures and do so within institutional frameworks which differ geographically and over time. The extent to which a rights structure offers advantages over alternatives eventually decides whether or not it survives.

4.1 Why property rights change

In broad terms, property rights can be said to "develop to internalise externalities when the gains of internalization become larger than the cost of internalization".[16] Conversely "to make costs and benefits externalities … cost of a transaction in the rights between the

trader in apples and pears, as it would have raised concerns about exploiting its market dominance in one sector to expand into another and it would have been difficult to implement with limited transferability of shares because that would have restricted access to the necessary capital.

[15] Collateral in particular raises the same issues. "The Navajo reservation, the largest of all reservations, is bigger than West Virginia, but only a handful of mortgages have been lent there. This is because reservation land is held in trust by the federal government, which until recently made it impossible to use as equity in a mortgage -- or equity in starting a business, the most common source of funding for small business start-ups. Only in recent years have lenders, with assistance from new government programs, found ways to make mortgages available." Washington Post, Sunday, October 13, 2002 pA03

[16] An action can have an effect (harmful or beneficial, pecuniary or non-pecuniary) on a third party. This effect is called an externality. Internalising an externality means that the effects of the externality are taken into account in the decision on whether or not to undertake the action. One means of doing this is through a change in property rights.

parties (internalization) must exceed the gains from internalization" (Demsetz, 1967, p348 and 350).

In other words, when the definition of a new property right is the least costly means of addressing a conflict over access to resources, then a right will tend to emerge. Conversely, when creating a right or maintaining an existing right is too costly, the conflict will manifest through other mechanisms, such as competitive harvesting, which will result in externalities for other users or society in general.[17]

There will be cases where these rights can be established at low cost (either informally or formally) by owners themselves, particularly where only small groups are involved, and cases where for society as a whole the benefits exceed the costs so that the state created and enforces the right. Otherwise no right will emerge.

Three particular factors which can trigger change include technological change (which can make access to resources feasible for the first time, reduced costs of obtaining or processing information or reduce the cost of defining and enforcing rights), new markets (due to technology, reduced trade protection, political shifts), changes in relative factor scarcity, and state intervention to define and enforce property rights in exchange for revenue (Pejovich, 1972).[18] Externalities imposed by land use can also change over time due to changes in community perceptions or the cumulative impact of use, thereby triggering a change in permissible land uses (see Section 4.3).

The level of resources invested in defining and enforcing property rights "will depend upon the marginal benefits and costs to investors" which change as the level of technology, scarcity and access to state power change (Anderson and Hill, 1975, p165).

An example in the Great Plains of the USA was the initial establishment of range rights. As settlement increased and land value rose these rights came under pressure, with moves to control grazing on public land, rules on fencing and laws to allow homesteading. The lack of fencing and low carrying capacity of land also resulted in stronger laws requiring livestock branding and registration of the brands, and joint roundups of stock. Enforcement activity increased when barbed wire reduced fencing costs and then declined when mechanisation reduced horse values (Anderson and Hill, 1975).

Many other examples exist of *de facto* rights evolving out of community resolution of resource conflicts. Such rights often draw on a level of information and enforcement that the state could not match, but tend to remain less secure than *de jure* rights unless explicitly recognised in law, at which time the regime becomes more rigid (Schlager and Ostrom, 1992).[19] In the Western USA, the high demand for water in gold mining drove a move from riparian rights (see Section 5.4) to discovery, appropriation and development as a basis for water rights. This approach was then followed for farming in Western states where water was normally scarce (Anderson and Hill, 1975).

Externalities can also exist between governmental jurisdictions. These can be resolved by the same techniques as for situations involving private parties through interventions

[17] Property rights can therefore be argued to be "endogenously determined by changes in the cost-benefit ratio", taking place "in response to the desire of interacting persons for more utility" (Pejovich, 1972, p310).

[18] For water the drivers for change have been argued to be scarcity, capital cost of water delivery, and the consequences of wider economic liberalisation, which increases the economic cost of inflexible and inefficient water allocation systems (Rosegrant and Gazmuri, 1995).

[19] It has been argued that a property right exists only where "some characteristic of a resource is subject to legitimate and legally protected voluntary alienation" (Bell, 1995, p610) but this appears to be too restrictive an approach. See for example the discussion of water rights of Australian farmers in Section 7.

defined by a higher-level government. These include regulation of the activity, incentives on the governments involved to minimise the effects, private property rights for those involved in the externalities, or rights and duties on the governments involved; ie, public property rights. It has been suggested that private rights enforced through the courts offer greater allocative efficiency, while public rights enforced through existing government structures offer greater administrative efficiency (Ellickson, 1979). This will depend on circumstances.

In most cases a legal framework that allows the parties involved to resolve the situation will be adequate, with the relevant governments becoming involved only in situations where a private resolution is not feasible due to the high transaction costs; eg, because of the number of parties involved, the difficulty of identifying the source or localising the impact of the externality. The same arguments will apply for involvement of a higher-level government versus a number of lower-level governments. Where such a higher-level government is lacking, as for most international externalities, resolution of disputes can be extremely difficult. Agreements such as the United Nations Convention on the Law of the Sea (UNCLOS) or the World Trade Organisation are an attempt to address this problem.

4.2 Private rights to government action

Much of this paper focuses on how governments define and limit enforce existing private rights. It has also been argued that "the development of private rights to government actions constitute the primary mechanism by which new property rights are evolving" (Nelson, 1986, p361). Whether or not this is accepted, the fact that rights have come into existence by this route is unquestionable.

Specific examples of this include (1) transfers, such as welfare benefits and low-cost housing (either public or rent-controlled), (2) regulatory controls, such as utility price controls or occupational licensing (eg, lawyers or taxi drivers), or (3) preferential access to public property, such as the supply of subsidised electricity or irrigation water or use of grazing rights on public land, or (4) zoning of land use (discussed in Section 4.3) (Nelson, 1986). This process can be seen as a form of privatisation.

A prominent form of private rights to government action in the USA relates to access to federal lands, noted under (3) above. Grazing permits are traded almost freely (though the restrictions that do exist and the uncertainty of tenure do limit their value) and the fees are significantly below the economic value of the use. Other examples include coal mining and timber harvesting, and a similar situation has now evolved with respect to tourism concessions such as river rafting. A property right is also evolving in respect of wilderness for hikers, bikers and others with an interest simply in preserving the conservation value of the land (Nelson, 1986).

The above rights have typically evolved from a use permit into a *de facto* private property right, but without full alienability of the right (Nelson, 1986). This results in a suboptimal situation where others are excluded from the property, and the government is unable to reallocate it, but the owners are themselves unable to fully obtain the benefits from it. Retention of the right may also be subject to regulatory requirements regarding use of the resource which are not consistent with maximising private or social values.

4.3 Community limits on property rights[20]

Property rights are not absolute or unchanging (Bromley, 1993). Any property right can be seen to be held subject to a general understanding of the constraints imposed by the community (expressed through judicial interpretation, statutory definition or direct community/peer pressure) with the knowledge that those constraints evolve over time, but that the right will not be unduly altered without consent or compensation.[21] This complex definition of course leaves much open to interpretation.

Alternatively, we can "describe property as the value … left after the inconsistencies between … competing owners" of interrelating property rights are resolved, while recognising that "new conflicts are always arising as a result of a change in … technology, or in public values" (Sax, 1964, p61). These changes can include altered perceptions of what constitutes an externality or spillover effect.

This impact of community perceptions on property rights has also been recognised in the New Zealand context; ie, "the balances in society are constantly changing and the legal rules, therefore, are in need of constant review and adjustment ….. the Government of the day must assume responsibility for assessing changes ….. they will be unlikely to gain broad acceptance until they have been developed through an adequate process, including appropriate consultation." (Legislation Advisory Committee, 2001, p9).

What constitutes a nuisance or an unacceptable externality created by use of a property right also changes over time. These changes can render what was a legal use (for example, a pig farm now surrounded by primarily residential properties) no longer legal.[22] Who then in effect has stopped that use, and who is liable for the costs of doing so – the affected neighbours or other beneficiaries of the abatement, the courts or the government? Is this a taking where government assumes or assigns control over all or part of a property right (or legal right) held by a private party? Whatever answer a society reaches on that question is ultimately implemented through a local planning process. The vulnerability of any property right to such action will tend to be reflected in its value (see Guerin, 2002 and Wilkinson, 2002).[23]

Local planning or zoning where only certain uses are allowed within a specified area or uses are prohibited except in a specified area, is the single largest restriction on property rights in land. In the USA zoning began as a "scientific" planning process but became "a discretionary system in which developers typically bargained with local government to gain permission to develop" with frequent overtones of corruption. The regularisation of planning as a property right has been suggested but has not occurred to date (Nelson, 1986, p365).

Planning can be seen as a means of maximising the aggregate value of the land within a jurisdiction and of constraining developments that could impose additional expenditure

[20] This section draws heavily on a previous working paper (Guerin, 2002).

[21] A subset of the general problem is when rules change after an investment has been committed based on an existing property right but before it is complete. These transition situations raise the same issues in general as for completed investments.

[22] The US Supreme Court in *Village of Euclid v Ambler Realty Co* in 1962 upheld a zoning change which banned a factory and caused a 75% drop in value, basing the decision on suppression of a nuisance (Epstein, 1999).

[23] A recent example of changes in property rights from Australia illustrates this. "The new coastal State Environment and Planning Policy … gives the Government the final word on all major developments along a one kilometre strip of the entire NSW coast. The Government will also be able to scrutinise all developments within 100 metres of sensitive coastal areas, although councils will still have the power of final consent, unless the minister chooses to intervene." Tide turns against beachfront palaces, Sydney Morning Herald, 29 October 2002

obligations, thereby requiring higher taxes (Fischel, 1999). This can create an equity issue by increasing the cost of housing in the area, with all the benefits going to the existing owners (as new entrants have the increase capitalised in their purchase price). Planning is also a means of addressing those externalities which are not well handled by the Torrens system of titles, including long-term and non-point source degradation (Johnson, 1992).

Another equity issue is the concept of grandfathering existing uses. This reduces the cost of bringing in new controls but creates inequities between existing and future residents, allowing the former to shift the full burden of changes onto the latter (Fischel, 1999). Spillover effects can also be a consequence of planning with undesirable activities excluded, or confined to locations where negative externalities primarily affect other jurisdictions (Fischel, 1999). This can be constrained by higher jurisdictions such as through National Policy Statements (NPSs) under the RMA in New Zealand (see Section 6.1).

4.4 Implementing a rights regime

The rationale for creating new rights regimes is generally to improve the efficiency of use of an underlying resource. Whatever the rationale, however, there are fundamental design issues to be resolved (see Table 5) which can require a significant bedding-in time for a new regime. In particular achieving the necessary quality of title requires detailed design and credible institutions which cannot be achieved overnight.

Those existing property rights that have evolved over time have established interpretations of the property right characteristics discussed above. When Government moves to define or substantially redefine a property right, however, it may have to establish such interpretations from scratch and do so in a manner that provides the owners of the new rights with the appropriate behavioural incentives. Such design must be undertaken with great care to avoid introducing new distortions that outweigh the intended benefits.

Table 5 – Designing new private property rights

General characteristic	Detailed Design Issues
Flexibility and divisibility.	Transformability of the right (eg, whether right holder can lease all or part of the right for less than its full term).
Exclusivity.	Excludability of others from use of the right, and whether use is rival.
Quality of title.	Whether the right is to an absolute quantum of resources, or to a proportional share of a pool, and if the latter on what basis the pool is determined.
	Whether the owner of the right must be compensated for changes in its value or terms.
	Institutions (including information requirements) are required to enforce the right.
Duration.	Whether it is permanent, or what the basis is for reallocation and whether the right holder would have any preference for future allocations.
Transferability.	The basis for initial vesting of the right.
	Whether there are any limits on transferability; eg, to who, at what price, how often.

Source: Scott (1988) and Scott and Coustalin (1995)

As Table 5 illustrates, establishing a rights regime requires going beyond simply defining the right, to establishing a register to record ownership, setting out the roles of government, institutions and individuals, defining conflict resolution arrangements and dealing with impacts on third parties. For some types of right environmental implications

are crucial requiring designers to address clear assignment of risks and procedures for compensation, and management of externalities of use (Rosegrant and Gazmuri, 1995). For natural resources in particular, key aspects of the regime include the nature of the long-term entitlement, the periodic allocations for use, and the conditions and obligations attached to use (Young and McColl, 2002).

Once rights have been created, arrangements are also needed to reallocate them to respond to changing demands and opportunities, including resource allocation between competing uses, and ensure secure and efficient trading and administration.[24] Banking of rights for future use, a major issue for environmental trading, also requires knowledge of whether and how entitlements grow or shrink over time and of whether rights expire if not used, and determination of who should own and run the bank (Siebert, Young and Young, 2000).

Markets tend to minimise these costs (relative to administrative allocation) but can result in high third party costs and may not achieve equity objectives. Markets, however, require a legal framework within which to operate. The limited liability and Torrens Title systems (see Section 6.5.2) offer examples of how a robust property regime can improve investment incentives through lowering title search and insurance costs.

Implementation plays a significant role in realising the benefits of a rights regime. Trading in environmental flows of water for example requires, in addition to well-defined rights and explicit trading rules, determination of whether environmental rights are prior to or competitive with other uses of the water and who has authority to manage any environmental rights.

All of the above depends crucially on information, which tends to fall short when it comes to environmental applications. Better environmental data "could dramatically expand the number of situations where a property-rights based approach to pollution control and resource management would be viable" and is a core Government function, although well-designed rights regimes can themselves encourage research by those affected (Esty, 1999, p1539).

5 Property rights in the environment

Arguments for creating new property rights in the environment are generally based on arguments that market failure caused by externalities requires corrective government intervention, or that the market failure itself is solely due to inadequately specified property rights and it can be fixed by completely specifying private property rights in the environmental goods. The latter point is a more debateable proposition than is often acknowledged, given the impact of transaction costs when large numbers of people, large areas and uncertain scientific information on impacts are involved.

This paper does not attempt to analyse whether there is a market failure in the environment (in general or in specific cases) or why such failures may arise (although lack of secure property rights is one example). Instead it deals with how a property rights

[24] The costs of doing so can include identification of opportunities, negotiation or decision on the transfer, monitoring third party effects, infrastructure for conducting and monitoring transfer of rights or the underlying resources, and infrastructure for monitoring third party effects (Rosegrant and Gazmuri, 1995).

approach can contribute to addressing such a failure, while recognising that the response must reflect the underlying cause.[25]

5.1 Intervention options – command and control or market-based instruments

Regulation of the environment, as for other regulatory endeavours, may be prescriptive through a Command And Control (CAC) approach as in Table 6, or more flexible through Market-Based Instruments (MBI) such as taxes or transferable permits or quotas as in Table 7 (IC, 1997). Much more detailed regulatory typologies are available but the key features are captured by these two categories and the key question for any approach is its cost-effectiveness (Cole, 1999). Both approaches create property rights, implicit or explicit, which affect the incentives of those being regulated.

Table 6 – Command and control regulation

Regulatory Instruments
Process or Equipment specification.
Input, Output, or Discharge quantity limits.
Disclosure requirements and audits.
Administrative process specification.

A CAC approach can mean there are "no firm-level gains from discovering and applying new technologies, since all producers will use the same technology", thereby creating both environmental and economic costs in the longer term. Restrictions on technology also hinder competition (Yandle, 1999, p11).

MBI approaches avoid these dynamic costs, and the negative environmental effects of subsidy regimes in terms of increasing use of energy, land, fertiliser and so on, but have been criticised as regressive (Steele, 1999).[26]

Table 7 – Market-based instruments

Instrument	Details
Volume-based taxes, charges or subsidies.	Based on emissions, effluent, inputs for harmful activities.
	Based on benefits of positive or less harmful activities?
Prevention or Remediation.	Clean-up charges - based on current or past activities.
	Deposit refund schemes to cover disposal or recycling costs.
	Performance bonds, fees for non-compliance or liability determination.
Transferable permits.	Allowing those facing high costs to buy permits from those facing lower costs, and encouraging new technologies.

Using MBIs effectively requires detailed knowledge, good governance arrangements, competitive markets, and adequate administrative capacity (Sharp, 2002). The similar

[25] Market failure can result from many causes typically involving transaction costs. These include imperfect competition (eg, monopoly), information problems due to the cost of obtaining the information or asymmetric information) , or the principal-agent problem where the differing incentives of the parties create problems around monitoring and enforcement of contracts. Regulation can attempt to address these problems but in doing so there is a risk of regulatory failure which may result in the market failure being inadequately corrected or even aggravated. The causes of regulatory failure include the issues cited above such but also problems such as resourcing, jurisdictional conflict, overlapping or contradictory objectives and capture by those being regulated.
For example, externalities can often be addressed through taxes/subsidies or permits, but information failures may require only Government provided information (HM Treasury, 2002).

[26] Common concepts includes Best Available Technology (BAT) and Least Cost Available Technology (LCAT).

requirements, however (including information needs), for applying a CAC approach effectively and efficiently tend to be under-rated.

Creating a market requires addressing the reasons why a market did not previously exist. Typical causes include high transaction costs, ill-defined or enforced ownership, uncertainty and asymmetric information (PC, 2002). Government intervention to better define a right, provide for registration and exchange and impose disclosure requirements can resolve these problems but is not a panacea (see Table 8). Problem areas in market design tend to be scientific uncertainty, market liquidity and the role of regulation.[27]

Table 8 – Desirable property right characteristics for creating markets

Characteristic	Description
1. Clearly defined.	Nature and extent of the property right is unambiguous.
2. Verifiable.	Use of the property right can be measured at reasonable cost.
3. Enforceable.	Ownership of the property right can be enforced at reasonable cost.
4. Valuable.	There are parties who are willing to purchase the property right.
5. Transferable.	Ownership of the property right can be transferred to another party at reasonable cost.
6. Low scientific uncertainty.	Use of the property right has a clear relationship with ecosystem services.
7. Low sovereign risk.	Future government decisions unlikely to significantly reduce the property right's value.

Source: PC (2002)

It has also been suggested that a complete specification of property rights would resolve environmental problems by internalising costs and relying on the incentives of private owners to conserve resources for the future. This, however, assumes that all environmental benefits can be internalised (so market prices capture all values) and that the necessary information will be available to owners, that scale economies are manageable, transaction costs are bearable, and that the legal framework will operate efficiently (Cole, 1999). These are not, in total, practical conditions. "Strengthened markets in environmental rights could reduce, but not eliminate, the burden on our regulatory system" (Esty, 1999, p1538). Even with such rights of course there is still a role for government (see Section 4.4) "in providing a structure of law to support the exchange of property rights and to ensure their vindication" (Esty, 1999, p1538)

5.2 Pollution control

Regulators seek to reduce pollution either directly through controls on emissions, or indirectly through controls on inputs. The latter leaves less flexibility for changes in process or emission control technology.

A CAC approach could involve a limit on the level of inputs or emissions, or on the type of technology used, while an MBI approach would classically either impose a tax per unit, or issue a fixed quantity of transferable permits (see Table 9).[28]

The purpose of using MBI in pollution control is either to reduce emissions by a set amount at the minimum cost (eg, through issuing a set quantity of permits) or to achieve the maximum emission reductions possible below a certain cost per unit (eg, through a flat

[27] Regulation does not vanish with a market approach. It remains crucial to the nature of the property right, its exchange, and enforcement (PC, 2002), while the procedures for changing it will impact strongly on views of the quality of title held in the right and therefore its value.

[28] Common concepts includes Best Available Technology (BAT) and Least Cost Available Technology (LCAT).

rate tax). MBIs also can also have positive fiscal effects through tax or charge revenue or from reductions in subsidies.

5.2.1 Pollution permits

Transferable permits have been suggested, and implemented overseas, for controlling pollution as an alternative to CAC regulation. This allows emission reductions to be made by those able to do so most efficiently, and allows those unable to achieve reductions to buy emission rights from others, to mutual benefit. It also creates an incentive to find more efficient means of reducing emissions (Cole, 1999) and is more flexible to changes in technology and other external factors; eg, in Chile firms were able to buy permits "instead of making irreversible investments that would have proved uneconomical ex post facto, that is, after the arrival of natural gas" (Montero and Sanchez, 2002, p269).

Such systems do, however, place a premium on accurate measurement of the initial problem, and of how it changes over time, since adjustments can be costly either in terms of compensation or through undermining the property right (such permits are property rights although they fall short of fee-simple title). The effectiveness of permits can also be affected by factors such as the liquidity of the market, the quality of the property right, and the existence of market power.

Whether initial allocations of permits are auctioned or grand-fathered can also have equity effects which can impact on the acceptability of the proposal.[29] It will not, however, affect the marginal incentives on firms once the permits are in place, since even firms which get permits for free will face an opportunity cost equal to their market value.

The formalisation of rights to emit can also be seen as a license to pollute which may not be socially acceptable.[30] While valuing adverse environmental impacts may be controversial, however, the acceptable cost of preventing such impacts is actually implicit in any regulatory decision.

5.2.2 Pollution taxes

A tax approach is more flexible than permits as the rate of the tax can be adjusted till the right incentive is created, although again certainty regarding future tax rates is a factor in the nature of the response.[31] The compliance costs for taxes are also lower than for permits. Taxes, however, are less certain to achieve a quantity target than permits. Road transport is an example of where the transaction costs of trading may make taxes more viable than permits in many circumstances (Johansson-Stenman, 1999).[32] Environmental taxes have been applied in areas such as water pollution, emissions (sulphur, NO_x, CO_2), waste (general, batteries, other toxic waste), energy use (petrol) and fertiliser.

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[29] Grandfathering can, however. create "economic incentives for incumbent sources …. to more readily declare their emissions and claim the corresponding permits", thereby improving the effectiveness of the regime (Montero and Sanchez, 2002, p268).

[30] When Germany introduced a combined standards (based on best practicable or commonly accepted technology) and charges approach to effluent discharges in 1976, the law banned further issue of licences, which created long-term vested rights requiring compensation when revoked, and replaced them with short-term permits subject to change or revocation as water quality requirements changed (Brown and Johnson, 1984).

[31] Tax approaches cover a wide variety of taxes and charges (or subsidies) from per-household to per unit of product consumed or emitted to a percentage of price, and includes waste collection or deposit-refund type schemes.

[32] Road transport also involves a mix of (often interdependent) externalities in terms of congestion, global pollution, local pollution, noise, accidents and road wear and tear. Instruments available include road charges (possibly varying by time), fuel standards, engine efficiency standards, fuel taxes and vehicle bans. A mix of instruments may well be appropriate.

Taxes also raise the possibility of a double dividend from using revenues from environmental taxes, which produce the first environmental dividend, to reduce other distortionary taxes through revenue recycling, producing the second tax efficiency dividend. The UK government for example has a specific policy to "reform the tax system to increase incentives to reduce environmental damage. That will shift the burden of tax from 'goods' to 'bads'; encourage innovation …. To the benefit of everyone" (HM Treasury, 2002, p5).

The strong form of the double dividend argues that the burden of the tax system can be reduced even if the environmental benefits are completely ignored. The environmental benefits are therefore free. The weak form suggests simply that revenue recycling is superior to revenue retention or distributing the revenue through lump-sum transfers.[33] Therefore the tax scheme will be more attractive if the revenues are considered than if they are ignored (Park and Pezzey, 1999). The weak form is more generally accepted than the strong form, and the latter does depend on the efficiency of the underlying tax system.

The level of revenue involved with a tax can itself be an issue. When revenue is significant in budgetary terms the opportunities for reducing less efficient taxes or recycling revenue into environmentally positive programmes are maximised, but the budgetary cost of successfully reducing pollution also rises. This conflict is less of a factor for smaller taxes.

5.2.3 Command-and-control vs the market in pollution control

MBI approaches overall avoid unnecessary costs that would arise from mandating use of certain technologies, or requiring that all polluters reduce emissions by the same proportion or amount, or other prescriptive approaches.

Such CAC approaches may, however, be sensible as an initial approach when faced with a major problem and limited information, when the information required to support an MBI approach cannot be obtained; eg, the first years of the Clean Air Act in the United States (Cole, 1999). Also the costs of an MBI approach "are assumed to exceed the operating costs of a system of fixed standards" so for there to be cost savings "there must exist some heterogeneity among firms" ie, if options for reducing pollution are limited or potential trading pools are small the gains from a more market-oriented approach may not justify the costs (Romstad, 1999, p52

The United States did later move to models such as netting off emission changes within a plant, offsetting changes between plants, allowing bubbles of grouped plants, or banking credits for future use or sale. A later move to full emissions allowances trading for sulphur dioxide emissions appears to have been successful in reducing emissions by more than projected at a lower cost despite costly monitoring and registry requirements. In all these cases, the benefits may have been constrained by the lack of security of the underlying property right but this is difficult to evaluate. Absolute security is not possible unless environmental goals are to be permanently fixed (Cole, 1999).

[33] Revenue recycling can be described as "polluters are effectively buying the right to pollute from the public" (Cramton and Kerr, 1999, p258)

Table 9 – Command and control versus market-based instruments in pollution control

	Command and control (CAC)		Market-based instruments (MBI)	
	Specified Technology	Quantity Limits	Tax[34]	Transferable Permit/Quota
Cost per unit.	Either fixed or open-ended upwards.	Open-ended upwards.	Maximum.	Market determined based on available and future technology.
Level of emissions.	Depends on specifications	Capped.	No cap. Actual level depends on how rate is set.	Capped, but may fall below cap due to flexibility of response.
Evolution over time.	Inflexible due to high costs of adjustment.	Inflexible with growing resistance to increasingly expensive reductions.	More flexible than CAC and less entrenched than permits. Needs updating for changes in economy, technology and environment.	Resistance to erosion of property right. Strong incentives for technological improvements.
Certainty.	Low as technology changes.	Low as over time the limits will prove to be either too strict or too lax.	Mixed as tax unlikely to fall but can be raised more easily than other forms of regulation can be changed.	Depends on consistency of administration, built-in review arrangements and whether changes are compensated.
Other Issues.			Can be seen as revenue raising device. Good for non-point source pollution. Can be conflict between objectives; ie, less pollution means less revenue.	Can be seen as privatising the environment.. Good for point source pollution. May involve offsets between positive and negative activities.

Trading or taxation approaches may also not be appropriate when faced with emissions that have a local impact (so that trading beyond a region will not achieve the goals), or that have a global rather than regional impact (so trading required international co-operation), or where available alternatives make a complete ban on a pollutant viable. Other key issues include whether pollutants are assimilative or accumulative, and whether the ambient concentration is uniformly or non-uniformly mixed spatially (Pennings, Heuman and Meulenberg, 1996).

It can also be argued that there is greater environmental risk with an MBI approach; eg, because it relies on monitoring that quotas are not exceeded, or on miscalculations of the cost of abatement under a tax system. Conversely, if an MBI approach is less costly for firms, then a more stringent environmental standard could be adopted. An MBI approach is also likely to create better incentives over time for improving technology (Romstad, 1999). It can be argued that incumbent firms support CAC approaches to reduce competition while environmentalists do so due to a lack of trust in firms, opposition to creating explicit rights to pollute and a preference for limiting industrial activity (Yandle, 1999).

Overall, an MBI tax approach sets a maximum cost for control measures, giving polluters an incentive to undertake any expenditure that reduces pollution at a lower cost than the tax rate. An MBI permit approach sets a minimum level of pollution, but is likely to achieve that level at a lower cost than otherwise and may reduce below that level due to innovation in pollution control measures. A CAC approach may achieve its targets, but at an unnecessarily high cost and with the risk of foregoing attainable pollution reductions.

[34] A tax is consistent with the polluter pays principle.

5.3 Fishing rights

The solutions discussed above are not, of course, limited to pollution problems. Similar approaches can be, and have been, applied to conservation issues such as ocean resources or endangered species.

A common example is fisheries. Historically fisheries have been either in sole ownership (by individuals or groups), which is generally only possible in freshwater fisheries where non-owners can be readily excluded, or open access, for inshore or deepwater fisheries. Aquaculture is also usually in sole ownership, although access to space to undertake it is a distinct issue.

It had historically been argued that fishing had no effect on fish populations or even that thinning out the population allowed the remaining fish to grow faster. More recently, it was suggested that fish catch diminished as catch effort increased, not just because of the law of diminishing returns but also "because of the effect of catch upon the fish population" (Gordon, 1954, p129). The collapse of the North Atlantic cod fishery (Kurlansky, 1997) among others has demonstrated the fallacy of the earlier views.

The fishing problem is a version of the tragedy of the commons referred to earlier. With ownership of fish determined by capture, no one has a property right until the fish are caught, so fishers race to catch the fish first and no one has a secure property right in future catches, so no one has an incentive to conserve.[35] Because there is no alternative means of converting the communal right to fish into a private right, fishers "must incur the larger social cost of depleting the stock of animals" (Alchian and Demsetz, 1973, p23).[36]

Initial attempts to resolve the excessive competition which was causing depletion, focused on administrative control of access through number of vessels or fishers, or constraints on types of gear or time spent fishing. These effort control measures tended to exacerbate the race for fish resulting in excess investment, higher operating costs and greater risk without necessarily reducing catches (see Table 10). Fishers tended to game the rules; eg, by increasing boat size or keeping boats at sea longer.

In the Pacific halibut fishery for example, the season dropped from six months in 1933 to 26 days in one region in 1952 as bigger and faster boats caught the available fish earlier at higher cost. Such regulatory approaches ignored the input cost of fishing (Gordon, 1954). The licensing process did, however, begin to create perceived rights in fishing which may have helped to bridge the gap to an individual rights approach (Scott, 1988).

Creating exclusive trading rights increases the value of existing rights, allowing compensation for any loss eg, for conservation reasons or traditional rights, while leaving rights holders still better off than before. Remaining users of the common resource have an incentive to conserve for the future, operate more efficiently (rather than race to extract their share of the resource before it is exhausted) and help enforce the quotas.

[35] A similar situation has occurred in oilfields where ownership of oil is at the wellhead, so neighbouring landowners have an incentive to drill competing wells and extract the oil as fast as possible, regardless of the effect on the total lifetime production of the oilfield. Compulsory pooling of interests has been used to address this problem.

[36] The alternative of eliminating the private right to fish also eliminates the individual incentive to work, requiring state coercion or cultural means to undertake the activity (Alchian and Demsetz, 1973).

Table 10 – Fisheries control techniques

	Effort Controls	Permits	Transferable Quotas
Impact on fishing techniques.	Incentives to invest in uncontrolled factors affecting fishing capacity.	Incentives to adopt techniques to maximise speed of catch.	Incentive to use most efficient approach.
Cost of fishing.	Possibly less than permits, but above most efficient level.	High.	Low.
Property right in future catches.	None within season. Possibly weak long term right depending on nature of controls.	None within season. Weak long term right if permits capped.	Strong.
Number of fishers.	Depends on nature of controls.	Uncertain, but above most efficient level.	Declines as more efficient fishers can afford to pay more for quota.
Sustainability of fishery.	Low as incentives encourage depletion and fishers bypass controls.	Low as incentives encourage depletion.	Potentially high depending on quality of scientific data and integrity of quota setting process.

The typical structure for such an approach involves defining a fishing zone, determining a Total Allowable Catch (TAC) and allocating Individual Transferable Quota (ITQ) within that TAC to fishers or communities. Compared to previous licensing arrangements the ITQ tends to offer greater duration, exclusivity, transferability and divisibility.

ITQ also offers administrative advantages as it makes allocation of reductions in TAC straightforward, allows for handling of by-catch by allowing fishers to buy or rent quota to cover it, allows fishers to choose between specialisation or mixed catches, and removes the need for control over gear other than to manage impacts of fishing on fish-stock composition or for environmental reasons; eg, to reduce seabird deaths (Scott, 1988).

5.4 Water rights

Water rights raise many of the same issues as for fisheries, but with some twists. These include such basic issues as the need to consider the science of hydrology rather than fish-stock replenishment and a focus on the flow of resources rather than an underlying stock. There are also, however, quite distinct issues such as whether a water right is based on priority (eg, the upstream user gets their full entitlement first) or is proportional to flow, how to deal with return flows of water after it has been used, whether the area of origin of the water has any preference in its allocation, and how to fund and manage the infrastructure necessary to supply the water and monitor its use and impacts (Rosegrant and Gazmuri, 1995).[37]

In addition, externalities take on a particular importance for water rights, given that water can be used multiple times. Important factors for downstream users include the level and consistency of flow, and the quality of the water (including temperature and other forms of pollution). Water also has residual users in the flora and fauna at all points of its flow, which rely on environmentalists and governments to protect their interests, and which produce positive externalities for water users and the general population. The interdependence of water users result in a "common property feature" with "far less exclusivity than a land right" (Scott and Coustalin, 1995, p822).

[37] Industrial water use raises particular issues, as it tends to represent a higher proportion of total water use when calculated on the basis of withdrawals than consumption (equals withdrawals less returns) and the volume taken and the manner in which it is returned can affect evaporation and other users through raising water temperatures. Water can be an input, a means of moving, cleaning or cooling inputs, turned into steam or simply used for cleaning (Renzetti, 2002). Industrial use may directly degrade water, while both industrial and agricultural processes can result in general water quality degradation through run-off.

There are also often stronger social and environmental perspectives in the discussion of water rights than for fisheries, and a more entrenched arrangement of existing rights, legal or customary. Water rights can be administrative, statutory or contractual; can be quantitative or limited only by impact on others, and can be conditional on continued use.

A fundamental difference in nature and source of rights (see Table 11) is between riparian rights based on ownership of land and protected by property law, and use rights protected by the law of torts. Overlaying these historically have been the concepts of prescription or adverse possession where actual use becomes a right of use, and seniority where chronological priority can be enforced by damages (Scott and Coustalin, 1995).

Table 11 – Types of water rights

Land-based or Riparian Rights (often water-taking permits in eastern USA)	Use-based Rights (often appropriative right or license in western USA)
Only owner of banks has rights to flow.	Rights exist as long as water use exists – land ownership is not essential provided there is legal access to the river.
Rights to undiminished, unaltered flow.	Rights are specific as to quantity and type of use.
Use may be at any time, in any way, and in any quantity, provided flow to other owners is not altered or diminished.	First user has strongest rights – seniority ranks rights.
Rights are relative and impose corresponding obligations – rights are equal regardless of area of land owned.	Rights-holders (users) can enforce rights only against those lower in seniority (later in time).
Full rights can be transferred only by transferring title to riparian land.	Usufructuary rights are fully transferable to any person.[38]

Source: Scott and Coustalin (1995)

Under Roman law, only temporary usufructuary rights could be acquired in running water, lasting as long as use continued, independent of land ownership but requiring legal access to the banks. The right could become prescriptive by unchallenged action over a period of years. Easements could be obtained to access a river across land.

Medieval common law treated a stream as static, so landowners owned their portion of a stream and had full rights to the water. However, upstream diversion deprived the landowner of property allowing damages to be sought. Non freeholders had no right to damages and no ability to enforce a use right except by a claim of prescription. A prescriptive easement went with the land and could be asserted against any other user of the flow. These easements were initially based on a grant of a use right but over time could also be based on simple prior use. Rights gradually evolved from land-based to use-based, linked to the flow of the river rather than the presence of water on land. This allowed non landowners to hold enforceable water rights. Prior use rights could also be quantifiable and transferable. It was also argued at times that equal riparian rights existed but that damages could only be sought by those damaged by a change in quality, quantity or manner of the flow.

These approaches evolved to a reasonable use theory, allowing reasonable use or diversion by riparian landowners, and a right to continued receipt of a flow, but only to seek damages once they began to use it. Ordinary and domestic users could take as much water as needed, while certain uses such as pollution, ornamental use or extraction from the river basin were per se unreasonable. Extraordinary use was permissible as

[38] Usufructuary rights means rights to enjoy the use and advantages of another's property short of the destruction or waste of its substance

long as other reasonable uses were not hindered. Seniority continued to apply to extraordinary use.

In the eastern United States, reasonable use evolved into a permit system. In the western United States, a system of prior appropriation evolved with use rights to take water at a specific location, but not tied to land ownership. Rights are transferable within restrictions (eg, to protect uses of return flows) and subject to seniority, beneficial use and outside regimes dealing with pollution and groundwater. Rights tend to be perpetual or at least long, and require compensation for expropriation.

The concepts of seniority and prescriptive rights clash with riparian rights, but offer advantages in terms of certainty and transferability, making them more valuable. The legal regime surrounding water is a network of private riparian and use rights, contracts, rights of navigation, fishing and foreshore access, and the government's right of expropriation (taking) and increasingly includes an ecological aspect (Scott and Coustalin, 1995).

The drivers behind changes to water rights regimes are scarcity (among agricultural, urban, industrial and in-stream use), capital cost of water delivery, and the consequences of wider economic liberalisation, which increases the economic cost of inflexible and inefficient water allocation systems (Rosegrant and Gazmuri, 1995). Systems that require users to pay for water use signal its scarcity value and provide revenue to fund measures to reduce water wastage.

6 Property rights to the environment in New Zealand

The most prominent example of the definition of new or redefined private property rights to natural resources of the environment in New Zealand is fisheries. Defined transferable fishing rights were created (see below for details) in response to the tragedy of the commons, discussed above, where competition for a scarce common resource resulted in depletion as no one had a secure property right in future use. Other rights discussed below are for pollution, radio frequency spectrum, water, minerals and land.

6.1 The Resource Management Act

As noted in Section 4.1, it can be argued that "when changes (in externalities) take place or new ones are recognised, the system of property rights is no longer efficient and efficacious" (Johnson, 1992, p172). The main vehicle for adjusting property rights in New Zealand is the Resource Management Act 1991 (RMA) through the preparation of national policy statements and regional and district plans, and their application by regional councils and territorial authorities to requests for consents to build on or otherwise use land.[39]

[39] New Zealand has 12 regional councils and 74 territorial authorities (15 cities and 59 districts). One city council and 3 district councils and the Chatham Islands Territory operate as unitary authorities, exercising regional council powers in their area. Six territorial authorities fall within the jurisdiction of more than one regional council. The RMA is administered by the Ministry for the Environment (MfE).
Application of the RMA is by:

- central government through national policy standards and call-in of significant consent applications;
- regional councils, through regional plans (the boundaries of regional councils are broadly based on catchments); and
- district councils, which normally fall within a single region, through district plans.

These statements and plans, and the way they are applied act to constrain, enforce and modify property rights in land. Those modifications are not compensable. With regard to the concept of takings noted in Section 4.3, the RMA explicitly states that plan provisions are deemed not to have taken or injuriously affected interests in land unless the Act explicitly says so (Ryan, 1998). This is effectively parliament contracting out, through statute, from the application of a takings approach to land use regulation.

Another perceived consequence of the RMA in New Zealand, according to anecdotal evidence, is that those potentially affected by a resource consent can seek compensation from landowners in order to not lodge or to withdraw an objection to the consent. Such a situation would effectively be recognising a property right by the neighbour in the consent.

The RMA makes only limited reference to market-based instruments (MBI) to achieve reductions in externalities, but "is silent on whether regional councils are authorised to use economic instruments" and "precludes the use of tradable instruments in point sources of air and water pollution" (Sharp, 2002, p57). It may not therefore provide sufficient authority for councils to develop the necessary processes to support MBI approaches generally. Section 5 illustrated that such approaches offer significant advantages in the right circumstances in terms of achieving environmental and conservation goals at minimum cost while Section 4.4 discussed the required institutional support to make them work. The relevance of MBI to water use is discussed further in Section 6.3.[40]

6.2 Pollution control

New Zealand does not currently use economic instruments to deal with general pollution issues. Smog in Christchurch is addressed by restrictions on wood and coal burning, while chlorofluorocarbons (CFCs) are banned and the response to air pollution in Auckland is use of lower sulphur fuel than is available in the rest of the country. There is currently "no legal authority for regional councils or district councils to implement economic instruments to deal with air pollution" (Sharp, 2002, p55).

Climate change policy is still under development. The Government's proposed package announced in October 2002 involves (1) an emissions charge on fossil fuels and industrial process emissions with revenue recycling (and an option for emission trading), (2) incentives for defined reductions in greenhouse gas emissions, (3) Negotiated Greenhouse Agreements where firms and industries with a significant competitiveness risk commit to best practice in managing emissions in return for exemption from an emissions charge, (4) initial exemption for the agricultural sector in exchange for investment in research on reducing agricultural emissions, and (5) Government retention of sink credits and associated liabilities allocated to New Zealand in recognition of the carbon sink value of post-1990 forest plantings and Government liability for deforestation up to a cap. The RMA will be amended to remove regional councils' ability to directly control greenhouse gas emissions through resource consents and regional plans.

[40] This section focuses on the RMA but water is also crucial to sustainable development policy and particularly to agriculture. The Ministry of Agriculture and Forestry (MAF) has done work on water allocation, including transferable permits. <http://www.maf.govt.nz/mafnet/rural-nz/sustainable-resource-use/water-efficiency/index.htm>

6.3 Water allocation and use

The initial allocation of water to users in New Zealand is governed by the RMA, although most existing water allocations pre-date its enactment.[41] In 1999 77% of allocated water was for irrigation, 7% for industrial use, and 16% for industrial water supply.[42] This covers both surface water and groundwater. Controls are based on minimum flows and water quality more often than through allocation limits, though cumulative impact is a factor in considering consent applications (Lincoln Environmental, 2000).[43]

No one can now take, use, dam, or divert water unless (1) allowed by a rule in a regional plan or a resource consent; or (2) the water is for an individual's reasonable domestic needs or the reasonable needs of an individual's animals for drinking water and the taking or use does not, or is not likely to, have an adverse effect on the environment (comparable to the English reasonable use approach discussed in Section 5.4).[44]

Consents are normally issued on a first-come, first-served basis, although the planning or consents processes allow for evaluation of competing uses of water flows, and apply for between 5 and 35 years, often with review at 5 to 15 year intervals. Over-allocation is normally addressed by reviewing consents (Lincoln Environmental, 2000).[45] Metering is not universal, but often applies to large takes.

The RMA provides for councils to introduce rights regimes in certain circumstances; eg, transferable permits to take (but not discharge) water (s.136), and in some circumstances permits can be transferred to another firm or another site provided both sites are in the same catchment. Councils have expressed concerns about lack of economic instruments and legal uncertainty around consent review clauses and measures such as waiting lists for new consents for over-allocated resources and controls on land use (Lincoln Environmental, 2000).

The RMA also requires the Minister for the Environment to consider the use of economic instruments to achieve the purposes of the Act, and regional/local administrators to have regard to alternatives including the provision of information, services or incentives and the levying of charges (including rates), based on the likely benefits and costs of each alternative (Sharp, 2002).

The RMA does not appear to allow for rights over stored water. This may not be an issue for privately owned lakes, such as an irrigation storage lake formed over privately owned land, but may cause problems where water is stored in a natural or publicly owned lake. Hydro generators, for example, use their dams to control flows out of their storage lakes in order to maximise hydro-electric revenue, subject to resource consent requirements about minimum flows.

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[41] Existing authorities expired by 10 October 2001. Existing rights expire by 31 October 2026. Mining privileges, which require compensation for limits on their exercise, expire by 1 October 2021 (Lincoln Environmental, 2000).

[42] About 80% of the irrigated area was in the Canterbury and Otago regions, of which about 70% was pasture.

[43] The key constraints for surface water allocations are minimum flows and water quality. For groundwater, when constraints do apply, they are normally based on groundwater level, pressure or water quality, often to prevent salt water intrusion for coastal aquifers. Takes are restricted in periods of shortage by stepped or pro rate cutbacks, bands of river flow, informal arrangements or transfers of permits (Lincoln Environmental, 2000).
Allocation limits for ground water are to maintain flows, ensure reliable supply, recharge groundwater, and maintain waste assimilation capacity of streams. For ground water, they are also used to avoid physical damage to the aquifer and prevent saline intrusion (Lincoln Environmental, 2000).

[44] Guidelines exist in New Zealand for reasonable domestic use, and in broad terms for irrigation, but not for industrial purposes.

[45] For example "the Taieri River …. Is seriously over-allocated and no new permits will be issued until existing ones are cancelled … once the water flow drops below a certain level, all permits are suspended upstream" New Zealand Environment, Issue 19 2002, 11 October 2002.

They presumably cannot use the RMA to stop anyone else taking water from a lake if that does not jeopardise the minimum flow requirements. This could mean that when inflows exceeded outflows, alternative users of the water would be able to apply for a resource consent for the surplus. This would be a problem for the generators if the return flows bypassed one or more of their hydro stations. It appears that, unless any environmental factors inhibited issue of a consent, any disputes would have to be resolved by private contractual means.

The two regions of New Zealand where water scarcity is most significant are Canterbury and Otago. Both regional councils allocate water on a first-come first served basis according to the requirements of land use. The allocation of water between productive uses and in-stream uses is evaluated through court action, partly because the relative value is not known and there is no mechanism (other than land acquisition) to guide water to its most productive use. Manawatu-Wanganui has a tradable permit system with ten year permits granted according to existing entitlements. Permits are transferable during periods of water restriction only, provided the end use is irrigation, both sites are within the catchment and the council is informed in advance (Sharp, 2002). Very few transfers, other than for land transfer or subdivision, have occurred (Lincoln Environmental, 2000).

Making a process for water allocation or re-allocation work is not straightforward. Water may only be available in specific places at specific times which may not correspond to when and where the water is required, leading to demands for water storage and transportation. Demand for water may also be simultaneous, as for crop irrigation, leaving little room for trade-offs, or conflict with environmental needs at certain times of the year. Allocations also must consider whether the water source is groundwater or surface-water, and the effects of how the water is used on the rate of groundwater recharge, which in turn affects aquifer levels and spring-fed streams. There can also be conflict between in-stream uses (eg, hydro-electric power) and extractive uses.

All of these factors act to limit the volume of trading in a water market quite apart from the transition problems involved in creating a new rights structure over existing water use arrangements. Restrictions (eg, for environmental reasons) on taking water from particular sources can also increase pressure on other sources, producing a less than optimal trade-off overall. Constructing a water allocation system that maximises economic and social outcomes while achieving environmental requirements is difficult.

6.4 Fisheries and aquaculture

Separate rights apply for wild and farmed fisheries as the former involves harvesting from an open-access resource while the latter is based on setting aside commonly owned seabed space.[46]

6.4.1 Deepwater and inshore fishing

A licensing system involving gear and area controls operated for New Zealand inshore fisheries from 1938 to 1963. The industry expanded rapidly after 1963, including into deepwater fishing following declaration of the 200 mile Exclusive Economic Zone (EEZ) in 1978. Moratoria on new permits were introduced for rock lobsters and scallops in 1978 and finfish in 1982, but fishing capacity and effort by existing permit holders were not controlled.

[46] Freshwater fish farming (eg, in artificial pools) does not raise any rights issues not covered under general law.

Deepwater quotas were introduced in 1983, and Individual Transferable Quotas (ITQs) introduced for inshore fishing and expanded for deepwater fishing in 1986. Quota entitlements were based on catch history. Where ITQs exceeded the allowable catch, most of the difference was dealt with by a buy-back programme with some pro-rated cuts for the remainder. There are maximum and minimum quota holdings for each species, and limits on foreign involvement. ITQs became proportional rather than fixed in 1990.

The ITQ regime operates by defining a Total Allowable Catch (TAC) designed to maintain the biomass of the fishery and after allowing for recreational and customary harvest, a Total Allowable Commercial Catch (TACC) which is then allocated to ITQ holders. Each ITQ represents a set proportion of the TACC, not an absolute amount, and reductions in the TACC for sustainability reasons are not compensated. There is no quantified allocation to recreational or customary fishers, so that expansion in these sectors puts pressure on the TACC. Effectively those sectors have a superior property right which gives them priority access to available fish stocks.

The Quota Management System (QMS) is now being extended to species, which were considered fully fished at the time it was introduced – these Fourth Schedule species were deferred because 20% of any new quota species must be allocated to Maori. This means that existing permit holders would receive less quota than their catch history would suggest, raising the issue of whether the increase in value of quota (transferable and quantified) over their previous permits is sufficient to offset that loss, or whether compensation is required.

The rationale for ITQs is to maximise the sustainable economic potential of each fishery. Other types of controls on fishing through limiting catch effort (number or type of ships, types of nets, days spent fishing etc) tend to be ineffective and distorting, with tendencies towards inefficient overcapitalisation.

Under an ITQ system the incentive to use quota efficiently is maximised and quota owners have stronger incentives to enhance the fishery because they know they will have their share of future catches. Such a system has, however, social and community implications because quota tends to become more concentrated and the number of vessels to decline over time under efficiency pressures.

The QMS has significant long-term environmental and commercial benefits from maintaining aquatic biodiversity. New Zealand is now also able to offer more consistent long-term supplies of fish products than other supply sources, and in some cases obtain a market premium for the sustainable nature of its fisheries.

6.4.2 Aquaculture

Aquaculture is currently subject to the Resource Management Act (RMA) process on the basis of applications as they come in; ie, first come first served; with little basis for controlling what areas aquaculture may occur in, no system for prioritising applications for particular areas versus other uses, and no system for charging for occupation of coastal space.

The new regime now being developed would create Aquaculture Management Areas (AMAs) as the only locations where aquaculture may occur, and establish a tendering system for allocating space within AMAs between potential aquaculturalists. Revenue from tenders is intended to be split between the central government and Regional Councils.

The AMA approach would both ensure that trade-offs between alternative uses of coastal space are made properly, and that aquaculture space is allocated equitably and efficiently. A moratorium has been imposed on applications not already notified to avoid the new system being pre-empted by locking up most potential AMA space and expanding aquaculture beyond areas where it is desirable.

6.5 Land title in New Zealand[47]

New Zealand land falls under 3 main categories, general land registered in the main titles and cadastral survey records administered by Land Information New Zealand (LINZ).[48] Maori land recorded with the Maori Land Court (though some is also registered with LINZ), and Crown (central Government) land, for which title either has never existed or has been extinguished on acquisition. Much Crown land has not been accurately surveyed.

6.5.1 Crown land

Crown land has not been held in title because this would involve the Crown holding land of itself, as in New Zealand the Crown holds the supreme or allodial title to land. Allodial title historically meant that the land was held in absolute independence, without being subject to any rent, service, or acknowledgment to a superior. Below this traditionally was feudal title where the land was held hereditarily from a superior in exchange for service when called on.

The best form of private land title available was fee simple or freehold, where the inheritor has unqualified ownership and power of disposition. This is what is normally meant by private ownership of real estate in which the owner has the right to control, use, and transfer the property at will.

Some Crown land is also held in long-term statutory leases. An example of this was Maori leased land where the Crown passed legislation to terminate the perpetual leases and paid compensation to the affected lessees.[49] Another example is the Crown pastoral lease land in the South Island, where a tenure review programme is underway. This will ultimately result in the land being either freeholded (to the lessor or otherwise) or being held directly by the Crown (usually through the Department of Conservation).

The Crown also owns land along many major waterways in New Zealand, often known as the Queen's Chain, although this is not as universal as is sometimes thought.[50] The Queen's Chain is generally 20 metres above the high-water mark, but in some cases is measured from the low-water mark. It may not extend all along the waterway, but may be

[47] This section discusses only the legal mechanisms by which land is held in New Zealand, including the English common law tradition. As noted earlier this paper does not address Treaty of Waitangi issues.

[48] Cadastral survey means determination and description of the spatial extent (including boundaries) of interests under a tenure system Historically a cadastre was a public register showing details of ownership and value of land; made for tax purposes.

[49] Leases were perpetually renewable, with rents fixed for periods of 21 years at a flat percentage of the unimproved value of the land. The changes (under the Maori Reserved Land Amendment Act 1997 and the Maori Reserved Land Amendment Act 1998) involved a shift to a fair annual rent based on the unimproved value of the land, more frequent rent review, and rights of first refusal for the lessor and lessee if the lease or land (respectively) were transferred.

[50] Only about 70% (anecdotally) of major waterways are adjoined by a chain, strip or reserve. The key statutory provisions that led to creation of the chain involved (1) reservation, on sale of Crown land, of a 1 chain (66 foot or 20.1168 metre) strip along rivers and streams above a certain width (Land Act 1892, Land Act 1948, Conservation Act 1987); and (2) creation, on subdivision of land to create any allotment of less than 4 hectares, of an esplanade reserve 20 metres in width along the high water mark or the bank of any river or along the margin of any lake (Resource Management Act 1991).

interrupted by private land or reserves. Beaches are generally open as the Crown owns nearly all foreshores and seabed (see below). Even where the Queen's Chain does exist, however, there is no automatic right of access through private land to reach it.

6.5.2 General land and titles systems

The most recognised type of land in New Zealand is general or private land, owned by individuals or corporations in fee simple.

General land ownership is controlled under the Torrens Title system, under which a register of land holdings maintained by the State guarantees indefeasible title to land included in the register.

Under the former common law title system a good title was established by a chain of transactions and events reaching back to a good root of title. This relied on conveyancing by deeds, whereby title to land was established by the production of deeds tracing the chain of title to the person who wished to pass on his interest in the land. The deeds system depends on the execution and preservation of original valid instruments, so that in the event of a deed being invalid, for example, through forgery or by operation of statute, no transfer is effected. Deeds systems require a high degree of expertise to operate and frequently require expensive title insurance systems to underpin property transactions.

The Torrens system made title to land dependent upon registration rather than on the execution of documents. The execution of title deeds (for example, transfers, leases and mortgages) was to be merely the means of obtaining registration and was not intended to affect the land or pass any estate or interest until registration. It has thus been described as a system of title by registration rather than registration of title and assures the person whose name is recorded as proprietor of a good title free from unregistered encumbrances. The central registry is the legally binding record of title to land.

There is, however, the possibility that the system might sometimes operate to deprive proprietors of their interests. The Crown therefore offers a guarantee of title for land held in the titles and survey records. The guarantee does not extend to the precise boundaries of the property specified on the title. The Torrens system and the Crown guarantee mean there is no need for private title insurance or for detailed investigations of title such as tend to be involved in a deeds system of title. This reduces the cost of purchasing land and increases the quality of title to land, improving incentives for investment in improvements.[51]

There is no general right of public access to private land in New Zealand, such as the public footpaths in the UK. This may reflect the recent development of the private land concept in New Zealand; ie, since 1840, the fact that so much land is held by the Crown, particularly through the Department of Conservation which controls about one third of New Zealand's land area, and the existence of the Queen's Chain.[52] The combined effect of these factors is to largely, if not completely, remove any need for a general access right.

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[51] The Torrens title system and the deed system are different means of achieving the same end, defining title in land. Both have the same implications for pre-existing land ownership such as aboriginal title.

[52] As at March 2002 (all figures net to avoid double counting) of New Zealand's 26.8 million hectares the Department of Conservation administered: on land - national parks 3.4 million hectares, reserves (land) 0.5 million hectares, conservation areas 4.3 million hectares, wildlife areas 88 hectares, and protected private land 81000 hectares; and at sea – reserves (marine) 0.76 million hectares, marine mammal sanctuaries 2.3 million hectares <http://www.doc.govt.nz/Conservation/Land/Protected-Areas-Administered-by-DOC/index.asp>:

6.5.3 Maori land

Maori land is defined in Section 129 (subsections 1&2) of the Te Ture Whenua Maori Act 1993/Maori Land Act 1993 as either Maori customary land or Maori freehold land. Transfer of Maori land must take the Act into account. Section 129 provides for a number of different types of status of land. The status of land will only change from Maori freehold land to general land upon registration of an Order of the Maori Land Court.

Maori customary land is land held by Maori in accordance with tikanga Maori. Maori freehold land is land the beneficial ownership of which has been determined by the Maori Land Court (MLC) by freehold order. Much Maori land is held by a large number of owners, many of whom may be deceased. Without a succession order made by the MLC, their successors will not be recorded on the title.

Maori freehold land came into being either by the Crown setting aside land for Maori from the Maori customary land that it purchased for the settlement of New Zealand (specific Maori individuals were granted Crown Grants for joint ownership of such land), or by the Maori Land Court investigating ownership of Maori customary land that had not been alienated and appointing (up to) ten Maori individuals into joint ownership.

Ownership of the land was confirmed by the Maori Land Court and title was granted by the Crown. The 1.3 million hectares of Maori land that remain today are the remainder of those original Crown Grants that have not been sold to non-Maori ownership or have not been converted to general land by its Maori owners.

6.5.4 Rivers, lakes and the sea

Ownership of rivers themselves is variable in the common law tradition, which generally applies in New Zealand outside Treaty of Waitangi obligations, with two main sources of ownership rights.[53] The first is from the Crown's prerogative rights in relation to the sea, which extend to the point at which the river ceases being tidal. Beyond that point the Crown, and the general public enjoy the right to fish, bathe and travel upon the river. The second source is the *ad medium filum aquae* rule where ownership of land adjoining a non-tidal river also includes with it ownership of the bed of the river to its mid-point. The bed is therefore privately owned but subject to the public's fishing and navigation rights.

Natural lakebeds generally are in Crown ownership under the common law principle that the English Crown held sovereign title to all lands underlying navigable waters.[54] In the case of artificial lakes, the landowner retains rights to the lakebed, and under common law generally also owns the right of use of the surface.

Aquatic property rights frequently relate to occupation and use (eg, access and withdrawal rights as noted in Table 4) rather than ownership, with the latter seldom alienated by the state.[55] Occupation of space, such as for telecom cables, mining, fishing, aquaculture or

[53] There is at least one Treaty of Waitangi claim outstanding in relation to a river bed, the Whanganui River claim.

[54] The bed of Lake Taupo (61,417ha) is vested in the Tūwharetoa Maori Trust Board along with the beds of its tributaries. Te Arawa Mäori Trust Board have a claim to the beds of 14 lakes (see list in the Native Land Amendment and Native Land Claims Adjustment Act 1922).

[55] The general US legal principle has been the public trust doctrine where foreshore and underwater lands up to the tide-line (submerged lands) are held in trust for the benefit of the public, who generally have the right to swim, fish, and walk along the shoreline and a right of access between high and low tide lines (though not necessarily the right to cross private land to reach that area). In the colonial era a number of royal charters and patents conveyed title to the land under water in eastern states to towns or private owners. In some cases states and towns also conveyed title to private owners. "An environmental land trust has turned its sights to the nation's oceans, acquiring 11,000 acres of Long Island bay bottom that once held some of the finest oyster beds on the East Coast. In

simply sailing or swimming may relate only to all the surface, the water column or the seabed (rather than the entire bundle) and is not always extractive or exclusive.

Ownership of the seabed raises separate issues from rivers and lakes due to the constraints of international law, and can also differs between parts of the seabed such as the foreshore, territorial waters, the exclusive economic zone and the continental shelf.

The foreshore, between Mean High Water Spring (MHWS) and Mean Low Water Spring (MLWS), or the high and low tide marks, is in New Zealand normally owned by the Crown and New Zealand has full sovereignty in this area.[56] The area above MHWS (ie, dry land) is primarily administered under the RMA by territorial authorities, with specific environmental responsibilities handled by regional councils.

The territorial sea lies between the low tide mark and the traditional 12 nautical mile limit.[57] In New Zealand the seabed, water column and surface in this area is owned by the Crown. New Zealand has full sovereignty in this area, subject to rights of innocent passage between MLWS and the 12 nautical mile limit.

The coastal marine area (CMA) is defined in the RMA as lying between MHWS and the territorial limit, with exceptions where rivers meet the sea (ie, the CMA includes the foreshore and the territorial sea). Management of this area is by regional councils with the Minister of Conservation rather than by territorial authorities.

The contiguous zone lies between 12 and 24 nautical miles from shore.[58] In this area New Zealand has the rights that apply within its EEZ and can exercise control to prevent and punish any infringements in its territory or territorial sea.

The Exclusive Economic Zone (EEZ) lies between 12 and 200 nautical miles from shore. In this 188 nautical mile wide area New Zealand has a sovereign right to use and manage resources of the seabed and water column.[59]

Continental shelf boundaries between nations beyond the EEZ are being delimited under the 1982 United Nations Convention on the Law of the Sea (UNCLOS). Nations have the right to explore and exploit seabed resources on the continental shelf, subject to sharing revenue from parts of the shelf beyond the EEZ.[60] Where the shelf extends beyond the EEZ New Zealand does not have jurisdiction over the water column or the surface which are part of the high seas.

Long Island, an English lord purchased the Great South Bay oyster beds from Chief Tobaccus in 1694 for the less than princely sum of 10 pounds . … underwater lands are owned, by and large, by states in the West and by a patchwork of state, county and private owners in the East." Washington Post, 22 October 2002 "In N.Y., Conservation Goes Underwater"

[56] The foreshore can also be defined as the area between the water and cultivated or developed land (Concise Oxford Dictionary) which would overlap with the Queen's Chain concept as noted above. Land previously vested in Harbour Boards or local authorities, or illegally reclaimed, was revested in the Crown by the Foreshore and Seabed Endowment Revesting Act 1991.

[57] 12 nautical miles equals 13.8 miles (approximately) or 22.224 kilometres (exactly).
200 nautical miles equals 230 miles (approximately) or 370.4 kilometres (exactly).

[58] These distances are all measured from the baseline which is normally MLWS but has exceptions for rivers, bays, islands, fiords, harbour works etc. Waters to landward of the baseline are called internal waters with full New Zealand sovereignty.
New Zealand has the fourth largest EEZ in the world of 405 million hectares or 4 million square kilometres. The continental shelf may cover another 1.5 million square kilometres.

[59] All states also have the rights of innocent passage through territorial waters, and freedom of navigation, over-flight, cable and pipeline laying and peaceful marine research within an EEZ.

[60] UNCLOS does not deal with the actual ownership of the seabed, the water column or any living resources beyond territorial waters.

The high seas are the water column, including the surface, beyond the EEZ. The area is the seabed and subsoil beyond continental shelves and is administered by the International Seabed Authority (ISA).

The RMA does not apply outside territorial waters, so there is no basis for authorising aquaculture or for considering the impact of seabed mining on the environment and other users. The Continental Shelf Act 1964 deals with prospecting and mining of petroleum (through the Crown Minerals Act) and minerals, and with sedentary species (through the Fisheries Act), but does not provide for processes for issuing licences, or for public participation, environmental assessment or monitoring.[61]

6.6 Other natural resources

Specific property regimes in New Zealand are strongly focused on natural resources, as evidenced by the discussions above on water, fisheries, land and land use. This is presumably because other forms of property are adequately covered by general law or intellectual property law and because of the common or open access nature of many natural resources. Two other forms of natural resources where specific regimes exist are minerals (where deposits often cross surface property boundaries) and radio frequencies (in limited supply and subject to interference).

In New Zealand, the Crown owns by statute a significant proportion of minerals, and issues prospecting, exploration and mining permits for them, based on first application.[62] Mining permits give exclusive rights to the permit holder, with their consent required before another permit for a different mineral (except petroleum) can be granted over the same area, but royalties to the Crown apply.[63] Non-Crown owned minerals are normally owned by the surface land owner. Much land is open to exploration without consent (Johnson, 1992), thereby limiting property rights in land, although access for mining is subject to general law.[64] The RMA controls use of land for prospecting, exploration and mining, with resource consents normally required other than for prospecting.

Use of radio spectrum for transmission is excludable but rival; ie, access to transmission rights can be legally controlled, but use of a particular piece of spectrum can affect other uses of the same or neighbouring spectrum. Use of spectrum for reception on the other hand is excludable, through encoding, but can be non-rival; ie, reception of a signal by one person does not necessarily affect reception by another person (eg, broadcasts are non-rival) Spectrum is generally non-homogenous, finite, non-depletable and non-storable.

Radio frequency rights are used for a range of services, including TV, radio, mobile phones, cordless phones, remote controls etc. The purpose of regulation is presumably

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[61] There is also the Territorial Sea, Contiguous Zone and Exclusive Economic Zone Act 1977 but no regulations have been made under it.

[62] Crown owned minerals in New Zealand include all petroleum, gold, silver, and uranium existing in its natural condition in land and any other mineral existing in its natural condition in land alienated from the Crown after passage of the Crown Minerals Act 1991 (except pounamu [greenstone], see Ngai Tahu (Pounamu Vesting) Act 1997), and every mineral reserved in favour of the Crown by any enactment notwithstanding the repeal of that enactment.

[63] For mineral permits where production is valued at more than $100,000 per year there is a requirement to pay a royalty to the Government of either 1% of sales revenue (ad valorem royalty or AVR) or 5% of profits (accounting profit royalty or APR), whichever is the greater in any given year. Where revenues are less than $1 million per year, the APR royalty does not need to be paid as only the AVR royalty applies. <http://www.med.govt.nz/crown_minerals/index.html>

[64] Mining in New Zealand includes greenstone, (pounamu), petroleum, gold, silver, coal, ironsand, aggregate, limestone, clay, dolomite, marble, pumice, salt, serpentinite, and zeolite.

to maximise the net public benefit from use of the limited spectrum resource through allocation to highest value uses. Radio spectrum was initially sold in New Zealand using second price then first price tender systems, however in 1996 an Internet based computer system was developed for the sale of spectrum by auction.[65] It is currently a multiple ascending round auction making all lots available for bidding at the same time.

7 Relevant Australian experience

New Zealand should also be able to draw usefully on Australian experience with using property rights and other market-based instruments in environmental policy, given the geographical proximity of, and legal and political similarities between, the two countries.

Australia has applied a wide range of market-based instruments in environmental policy. These include trading mechanisms, information disclosure (auctions or labelling to address asymmetric information), fees, taxes and subsidies and individual negotiations. The targets have been effluent, trade waste, ozone depleting substances (IC, 1997). There have also been a range of environmental resource goals "such as conserving biodiversity, reducing salinity, rehabilitating wetlands, allocating water within environmental limits and reducing in-stream nutrient levels" (Action Salinity & Water Australia, 2002, piv).[66] Specific examples of instruments include a salt credits scheme to address river salinity, and tax and rate concessions for preserving native vegetation (IC, 1997).[67]

Evidence from Australian studies suggests that the success of markets depends on the cost of defining and enforcing ownership, certainty, information and liquidity. Climate change measures have therefore been suggested as promising candidates for markets in ecosystem services (based on the criteria in Table 8) while biodiversity is significantly more difficult.

The biggest problem areas identified in market design in Australia have been scientific uncertainty, market liquidity and the role of regulation (PC 2001 and 2002, IC 1997). A major proportion of the Australian experience relates to forms of water rights.

Australian water policy focuses on allocating limited water resources and managing salinity problems. Water use is similar to New Zealand, with Irrigated farming accounting for 75 per cent.[68] Use rose by about 65 per cent between 1983 and 1997, mostly because of increased irrigation, while urban and industrial water use declined.[69]

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[65] The Radiocommunications Act 1989 enabled the creation of property rights for spectrum and also the use of market driven allocation mechanisms for the distribution of the newly created rights, but .did not specific any particular allocation mechanism. For details of New Zealand's radio spectrum management regime see <http://www.med.govt.nz/pbt/rad_spec.html>.

[66] Relevant links include CSIRO Land and Water <http://www.clw.csiro.au/> National Action Plan for Salinity and Water Quality <http://www.napswq.gov.au/> Land & Water Australia (a statutory research and development corporation) <http://www.lwa.gov.au/> National Water Reform Framework <http://www.ea.gov.au/water/policy/coag.html> a fact sheet on the framework <http://www.affa.gov.au/corporate_docs/publications/pdf/nrm/factsheets/water-reforms-factsheet.pdf> a paper on national water trading <http://www.affa.gov.au/corporate_docs/publications/pdf/nrm/water_reform/national_approach.pdf>

[67] This is also an example of how removing polices which encourage current land-management practices, such as low interest agricultural loans for drought assistance and uncertain leasehold tenure, can improve management incentives. "Crown leasehold land makes up more than two thirds of all privately controlled land in Australia. Almost all …. Involves pastoral leases." (PC, 2001, p16-17). Leases normally have grazing or stocking provisions, may have public access rules, are subject to Crown rights to resume or to undertake activities on, and may be subject to Native Title.

[68] Not all irrigation is created equally – the return per litre of water varies by crop and by region, while the type of irrigation technology used can make an order of magnitude difference in the water use per hectare for any particular crop.

[69] "Drought-proofing nation brings torrent of ideas", Sydney Morning Herald, 16 October 2002.

A national water framework was agreed by the Council of Australian Governments (COAG) in 1994 for implementation by states and territories by 2001 (in 1999 full implementation was extended to 2005). Implementation was included under the National Competition Policy (NCP), with payments from the Commonwealth based on progress.[70] The framework includes pricing reforms to achieve full cost recovery, revising rights to ensure allowance for environmental needs, and giving farmers a legal property right to the revised allocations. Allocations are to be specified clearly in terms of ownership, volume, reliability, transferability and quality and be separate from land title. For urban supply, the process includes two-part tariffs (access and volume), transparency (and preferably removal) of cross subsidies, and separate disclosure and payment of community service obligations. New rural supply developments must be economically viable and ecologically sustainable. Institutional reform involves devolution of irrigation scheme management , and separating water resource management from standard setting and enforcement.

There has been some progress on water trading.[71] New South Wales now has 10 year licences with varying degrees of supply security, administratively determined licence charges and market prices for transfers (geographically restricted but including some inter-state trades within catchments). Most traded water was not being used (Sharp, 2002). Victoria limits transfers out of an irrigation district to 2% of the total entitlement, and allows only downstream trading in unregulated streams.[72] All states are required to have intra-state trading systems by June 2003 and an allocation method between farming and environmental needs, with an inter-state trading system by June 2004.[73]

Revision of rights has been delayed, partly due to a dispute over whether there should be government compensation to farmers for the initial reductions in their allocations.[74] This reflects the manner in which incompletely defined rights can become effectively vested over time, leading to windfall gains for recipients (see discussion in Section 4.2) and illustrates the range of technical and institutional constraints that can hinder implementation of a property rights approach to water management. Such issues should not , however, affect the longer-term outcomes of such an approach as long as effective trading arrangements are put in place.

8 Conclusion

Property can generally be held in private, common, public and open access forms of ownership and management. The confusion between common and open access property can be addressed by making clear that for the former access is limited to members of the common group while the latter is completely uncontrolled. The tragedy of the commons is likely to occur sooner and more seriously for open access than common property.

Property rights exist in the context of social/legal rules and evolve as society, technology and institutions change. Increasingly rights derive from Government action, whether explicitly or implicitly. Rights also are increasingly constrained by local planning or zoning

[70] <http://www.ncc.gov.au/>. Remaining elements have been prioritised over the 2002-2005 NCP assessments. "2002 National Competition Policy Assessment Framework for Water Reform" <http://www.ncc.gov.au/pdf/AST4AsFrWa-001.pdf>

[71] Recently there have been calls for "a national water bank allowing trading, electronic transfers and a licensed system of brokers … Responsibility for water, including the issues of compensation and environmental flows for rivers, should be managed by the Federal Government, with consideration given to a system of registration and trading that includes exchange rates and third party obligations." "Water: so precious you should be able to bank on it", Sydney Morning Herald, 11 October 2002.

[72] 2002 National Competition Policy Assessment Framework for Water Reform <http://www.ncc.gov.au/pdf/AST4AsFrWa-001.pdf>

[73] "NCC tackles rural water reform" The Australian Financial Review, 9 December 2002.

[74] "Farm groups back water compensation" The Australian Financial Review, 7 November 2002.

changes. Making new or modified rights work within these constraints and those imposed by existing rights structures can be very complex, expensive and slow The difficulty of such implementation, including the creation of the necessary institutions and assembling required information is often underestimated.

Comparing rights is difficult but can be assisted by applying a common set of characteristics such as flexibility, divisibility, transferability, quality of title, exclusivity and duration. This does clearly illustrate differences such as freehold versus leasehold land, and the nature and rough size of the tradeoffs involved in decisions such as restricting the transferability of assets to preserve indigenous control.

The role of rights in environmental policy tends to focus on issues of scarcity and environmental damage; ie, allocating resources to the best value use and minimising pollution or other negative environmental effects of resource use. Both Command-and-Control (CAC) and Market-Based-Instruments (MBI) affect rights but the latter more actively uses allocation and exercise of rights to create desirable incentive effects. Ain very simple terms, a CAC approach requires the use of certain techniques or imposes specific limits with no constraint on the cost to be incurred, while a MBI approach uses taxes or permits to achieve maximum improvements at a specific cost or a specific level of improvement at a minimum cost.

Fishing rights are a classic example of the failure of CAC approaches such as controls on duration of fishing or types of equipment used. New Zealand, conversely, has had considerable success with using Individual Transferable Quotas to create incentives for sustainable fishery management. Water rights, however, are not so easily addressed with major complications around information and technical issues, vested rights and ecological needs.

New Zealand has made extensive use of rights regimes to manage resources such as fisheries, land, minerals and radio frequencies and is developing such a regime for aquaculture but lacks a comprehensive approach to water management (where the current Australian reforms should be of use) and has only limited ability to trade off competing uses within the Resource Management Act.

This paper is intended to lay out a preliminary foundation for applying a property rights perspective to environmental policy issues facing New Zealand rather than apply such an approach to any specific issue. In this context a few general points can be made.

First, there can be a quite false dichotomy between the use of regulation and the market to achieve environmental and conservation objectives. Regulation by any form, whether through command-and-control means or market-based instruments, inevitably creates, modifies or reassigns property rights in some way. The choice is about which approach achieves the optimal national welfare outcome.

Secondly, if such discussion points to more use of market-based instruments, significant work will be required to create the legal and institutional framework needed for their effective application. Getting from theory to successful practice can be complicated, slow and frustrating, particularly for trade-offs between social, economic and environmental outcomes or when the resources to which the rights relate are not uniform in quality, location or other aspect (water trading raises such issues). These difficulties are illustrated in the New Zealand context by the lengthy and ongoing process of designing and implementing the current fisheries ownership and management regimes, and in the frustrating experience in both New Zealand and Australia with water management.

Finally, there is no general answer for these problems, but an open discussion of what the objectives of a particular rights regime are, of how that affects the characteristics of the rights and future management of the underlying resources, and of what trade-offs need to be made and by whom, can only improve the overall outcome for society.

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